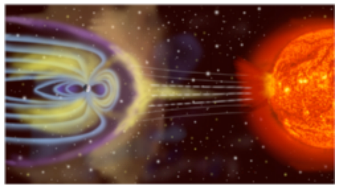


Overwhelming Auroral Wind O^+ Contribution to Plasma Sheet (Halloween 2003 Storm)

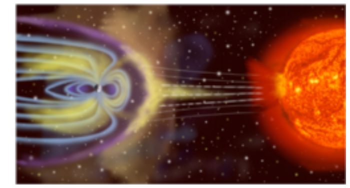
M Nosé, S Taguchi, K Hosokawa, S P Christon, R. McEntire, T E Moore, M R Collier,

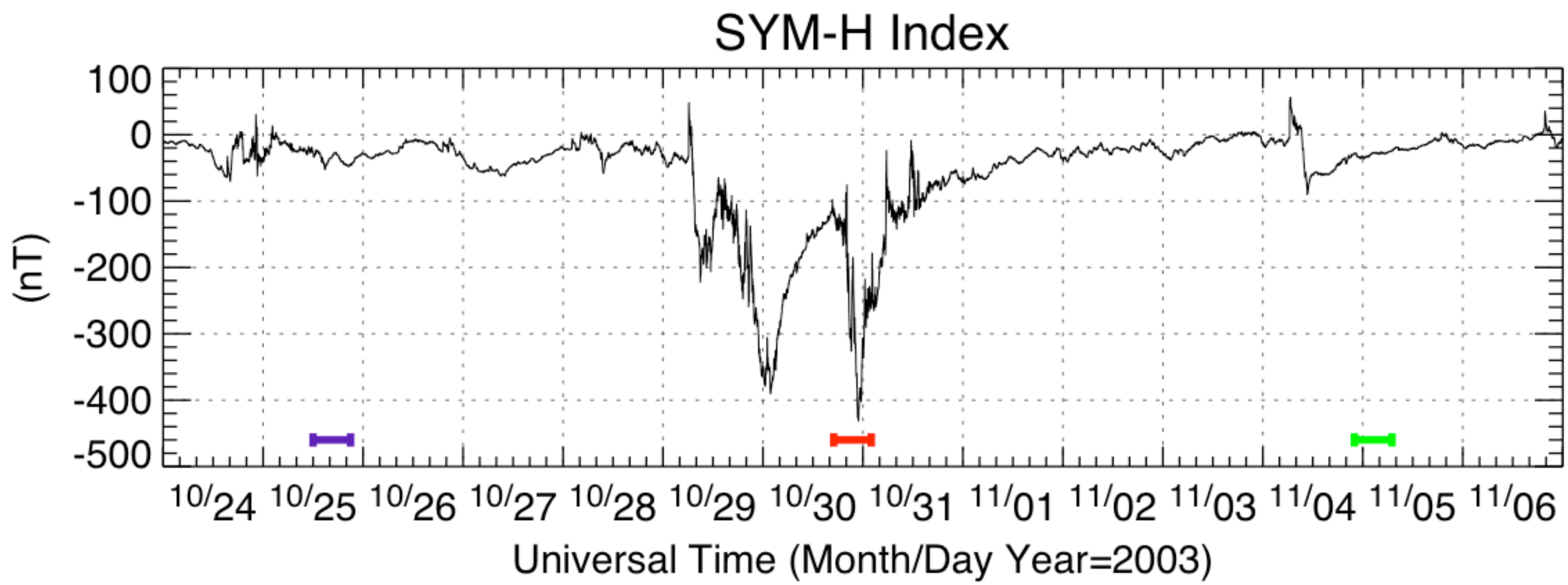
JGR, in press, 2005

T E Moore, M-C Fok, S P Christon, S Chen, M O Chandler, D C Delcourt, J Fedder, S Slinker, M W Liemohn,

GM 1064, in press, 2005

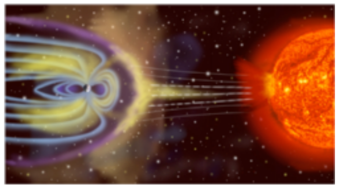
Halloween Storm "D_{ST}"

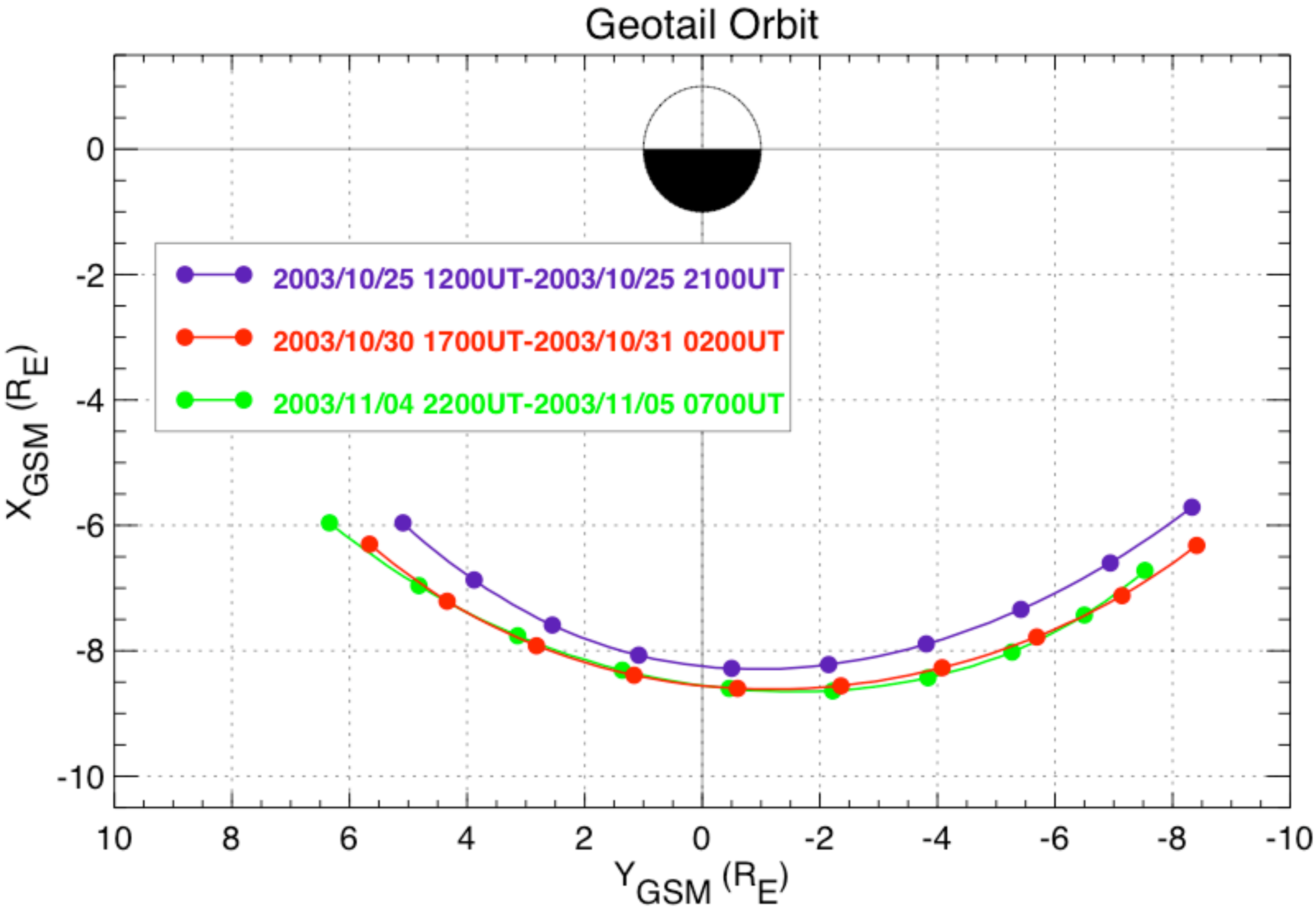




- BRG bars refer to Geotail EPIC analysis periods, in what follows

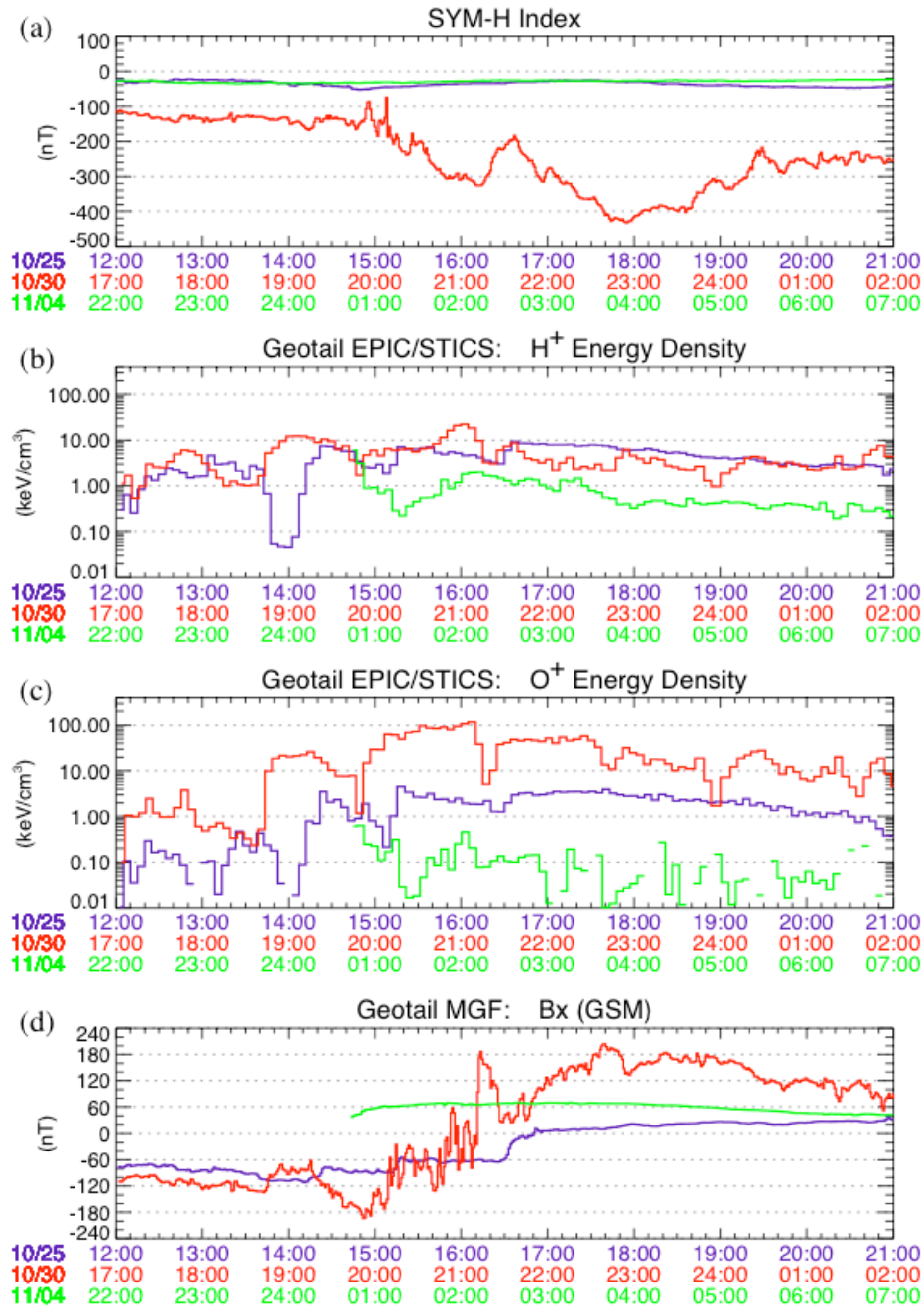
Geotail Passes (1 hr tics)





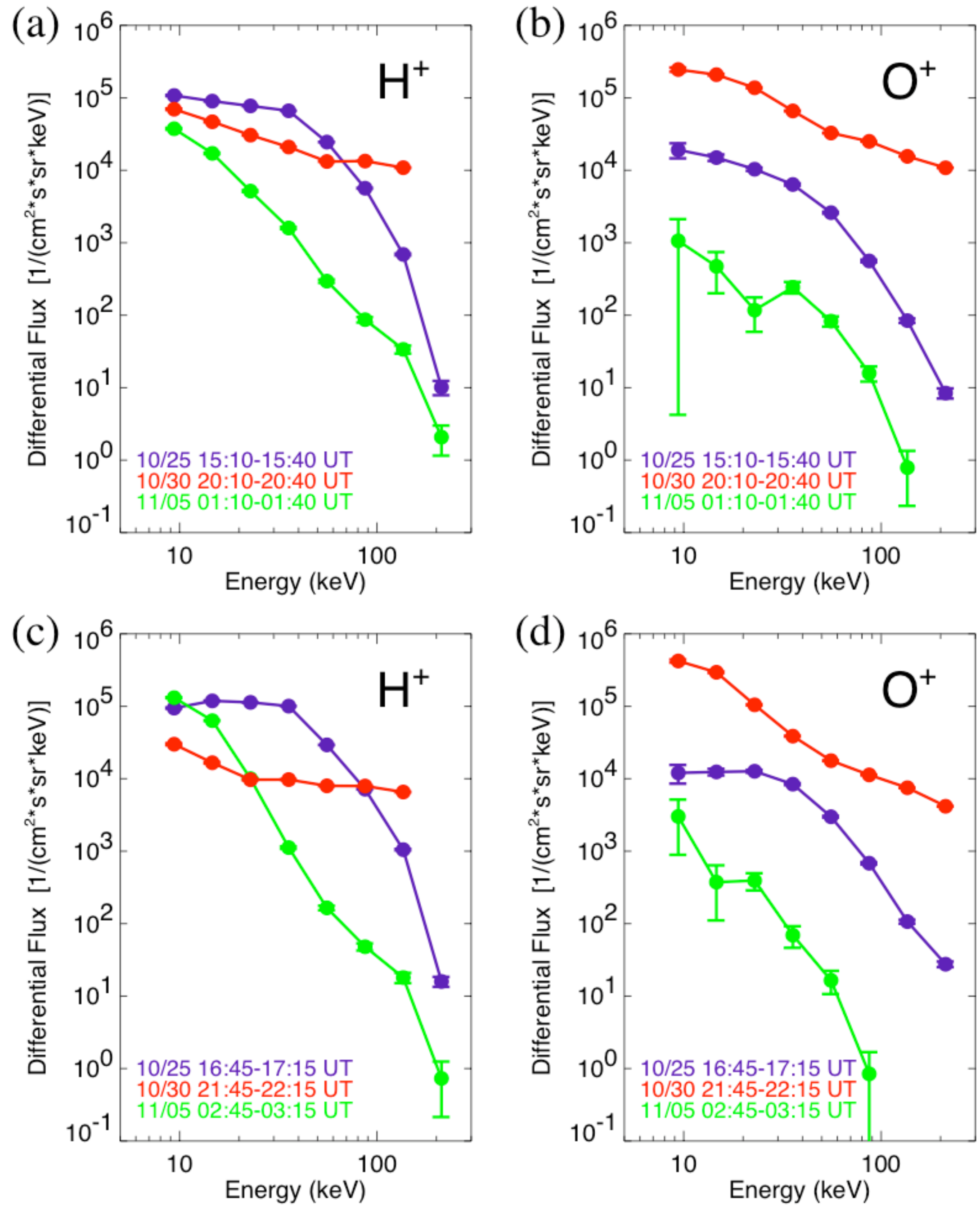
Epoch Data Plots

- BRG plots map to passes per previous
- First O+ enhancement preceeds main phase
- Largest enhancement during rising phase to maximum
- Bx reversal at Geotail indicates neutral sheet crossing, spatial effects

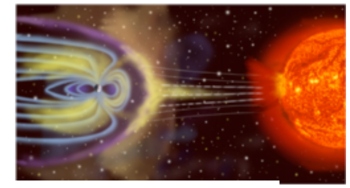


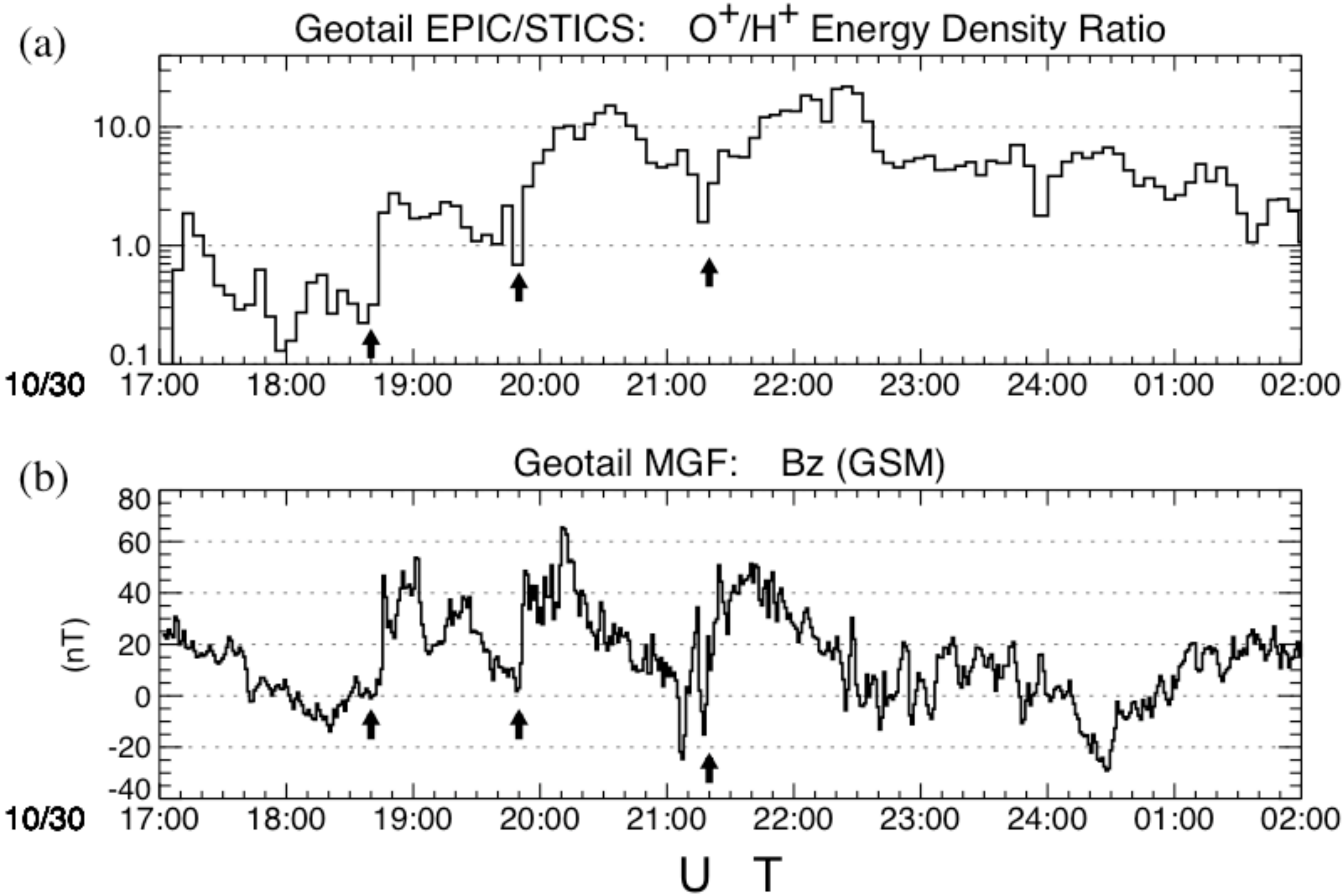
EPIC Energy

- Same BRG ordering
- (a), (b) early
- (c), (d) late
- See accumulating flux at higher energy first, then lower

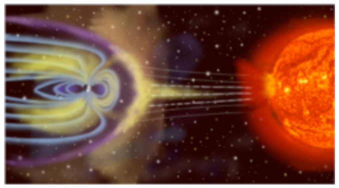


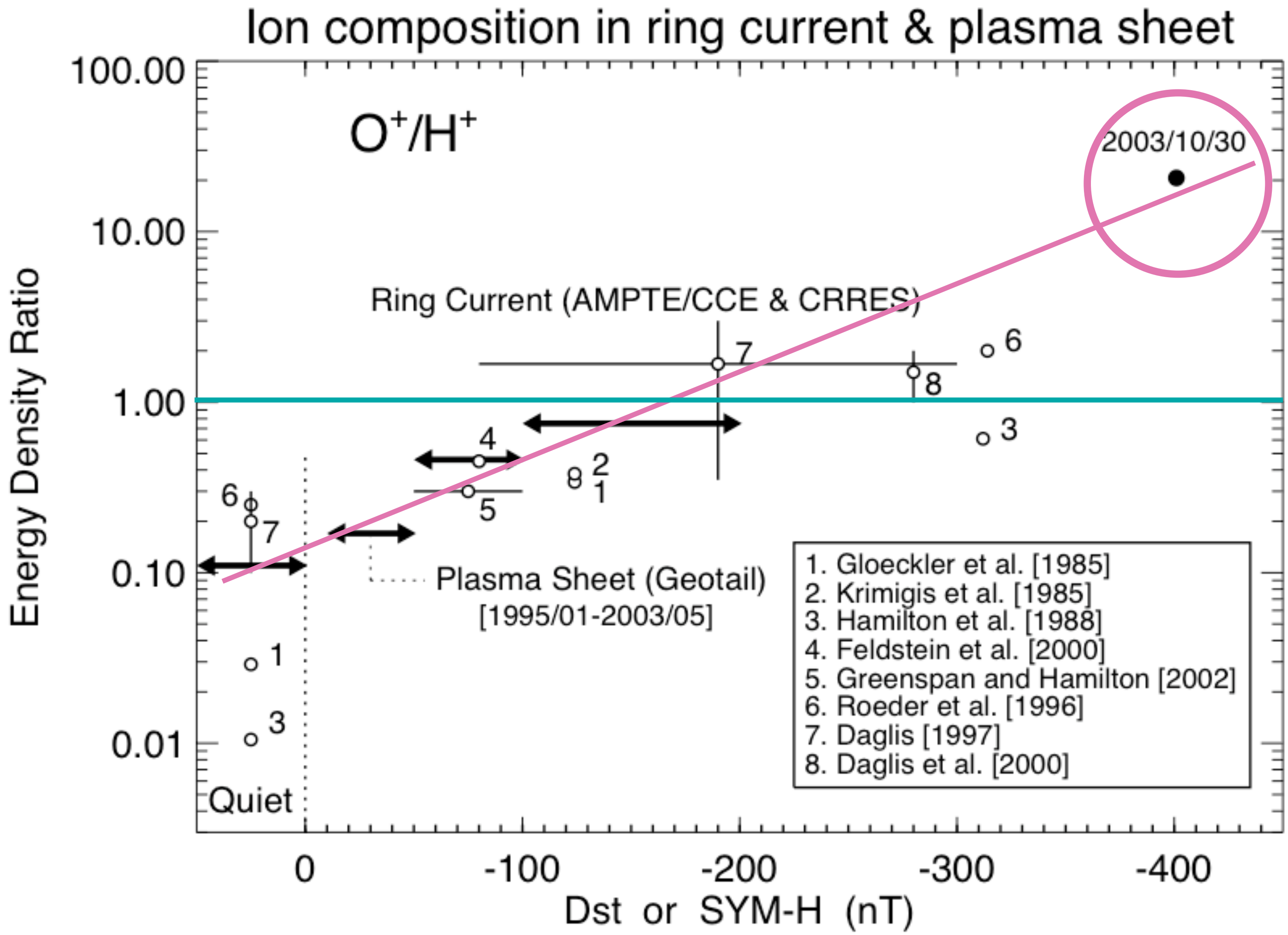
Partial pressure ratio (Red Trace)



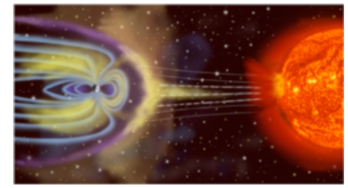


Halloween 2003 on D_{ST} Trend

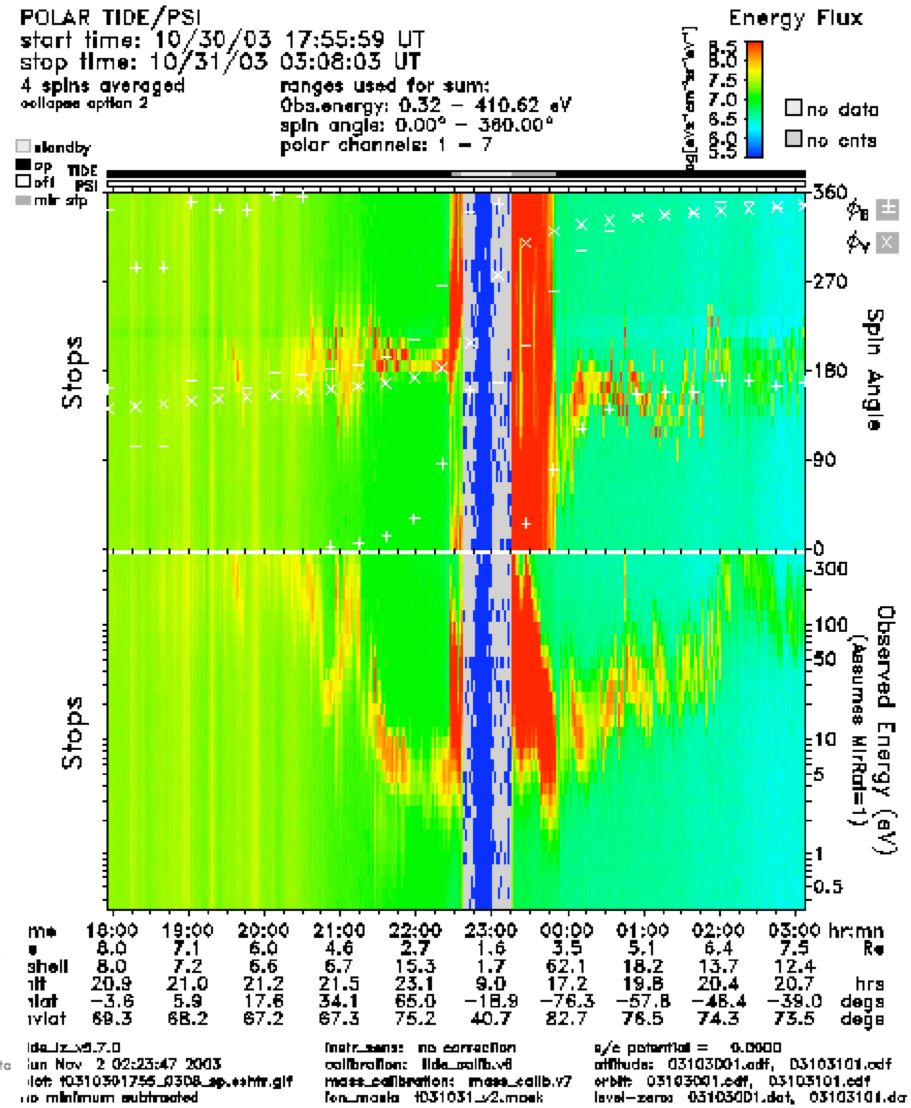


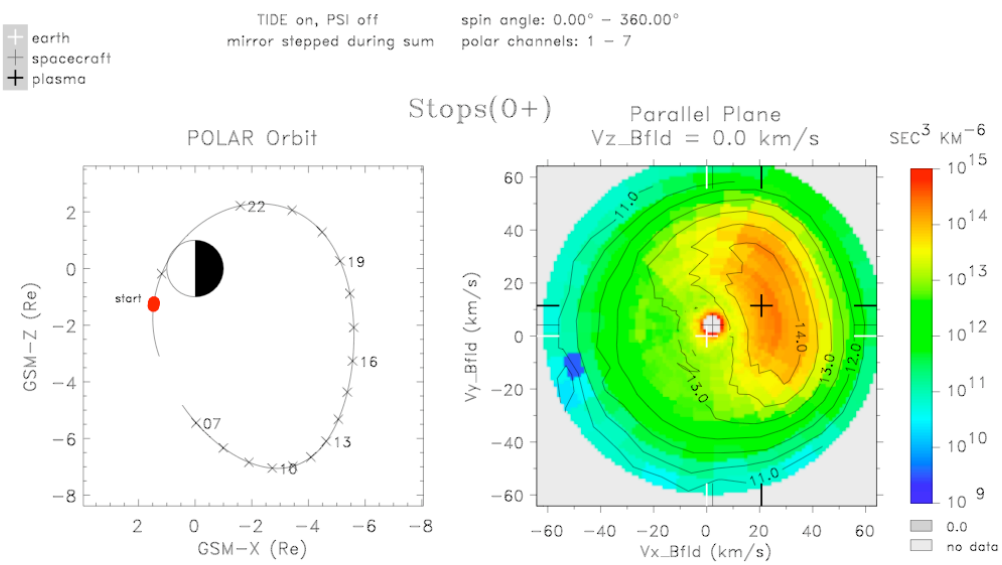


TIDE Outflow Observations

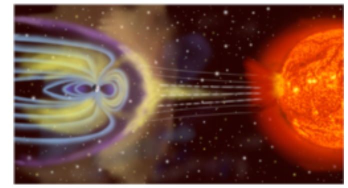


- Polar perigee pass occurs near peak ring current
- Largest outflow flux event seen by Polar in dayside cusp: $1.5 \times 10^{10}\ cm^{-2}s^{-1}$ =
- 10 x 24-25 Sept 1998 IME
- Nightside auroral outflow comparable but cooler





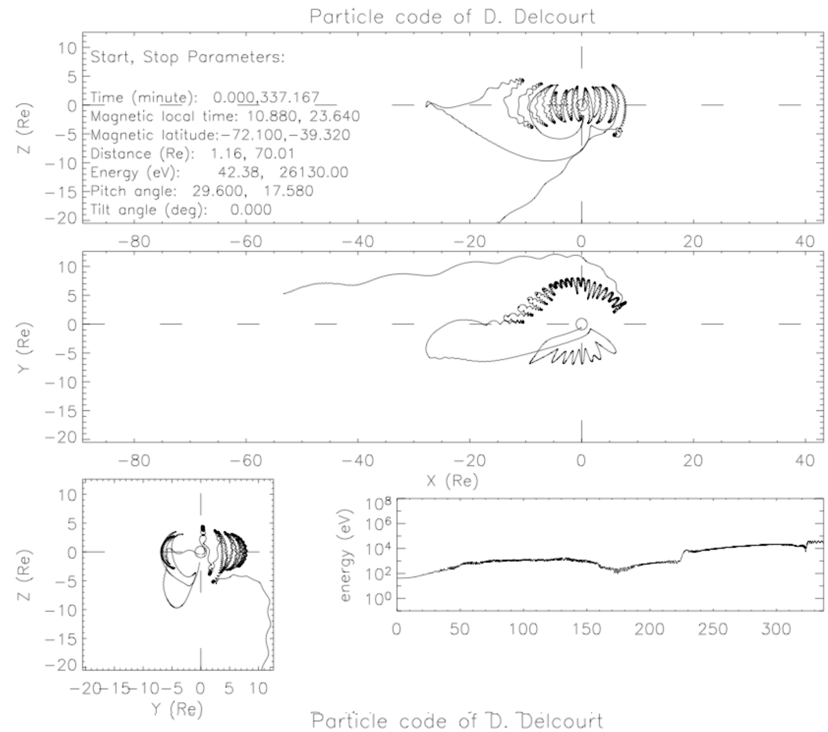
Solar Wind Driven Auroral Wind: Response to Dynamic Pressure Increase

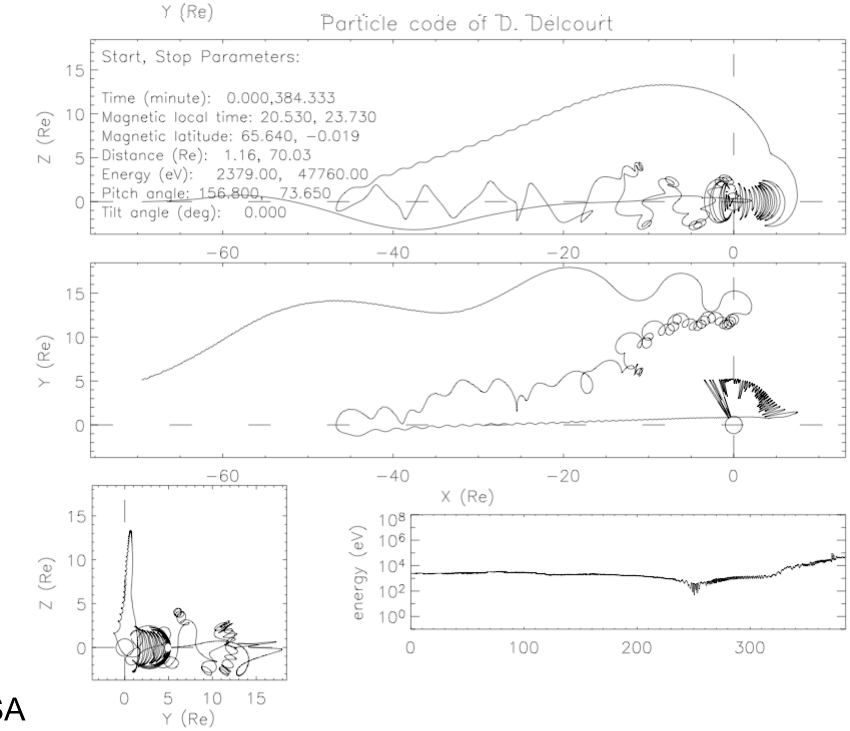


- Motivation
  - Responses to protoyptical solar wind disturbances
  - Model single particles in MHD fields from LFM
  - Auroral Wind (O^+) considered here (see below for solar, polar wind)
  - Auroral Wind fluxes driven by MHD ionospheric b.c.
    - **S** and Ne-Hot drive flux; **S** drives ion Eth; J// drives ion E//
  - Pd enhancement by order magnitude in 5nT By only solar wind
- Results
  - Pre-existing IMF By producing substantial convection at 0.4 nPa
  - Sets off substorm shortly after pressure jump to 4.5 nPa
  - Dynamic ionospheric boundary conditions drive large outflows
  - Produces ring current-like pressure increase
- Moore, Fok, et al., JGR Feb 2005 “Solar and Polar Wind…”
- Moore, Fok, et al., AGU Monograph 1064, 2005
- Dynamic boundary conditions manuscript in preparation

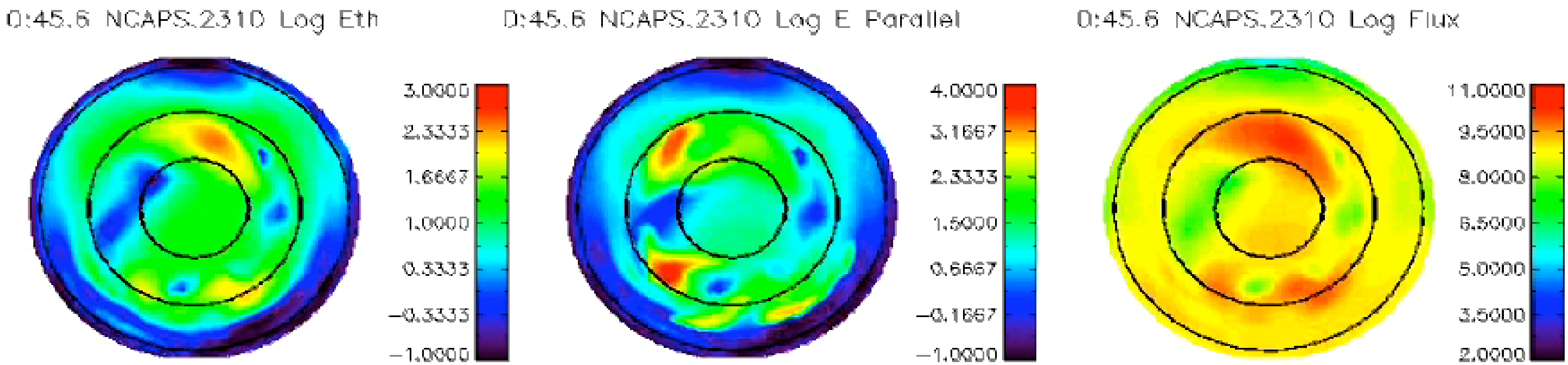
Model Setup and Solar Wind Trajectories

- Delcourt [1993] full equations of motion w/ g
- 4th order Runge-Kutta
- Time step 5° gyrophase
- Linearly interpolated MHD fields from LFM simulation
- Spherical MHD grid with axis along Xgsm.
  - Polar resolution 2°
  - Azim resolution 5.5°
  - Radius varies with r, Polar



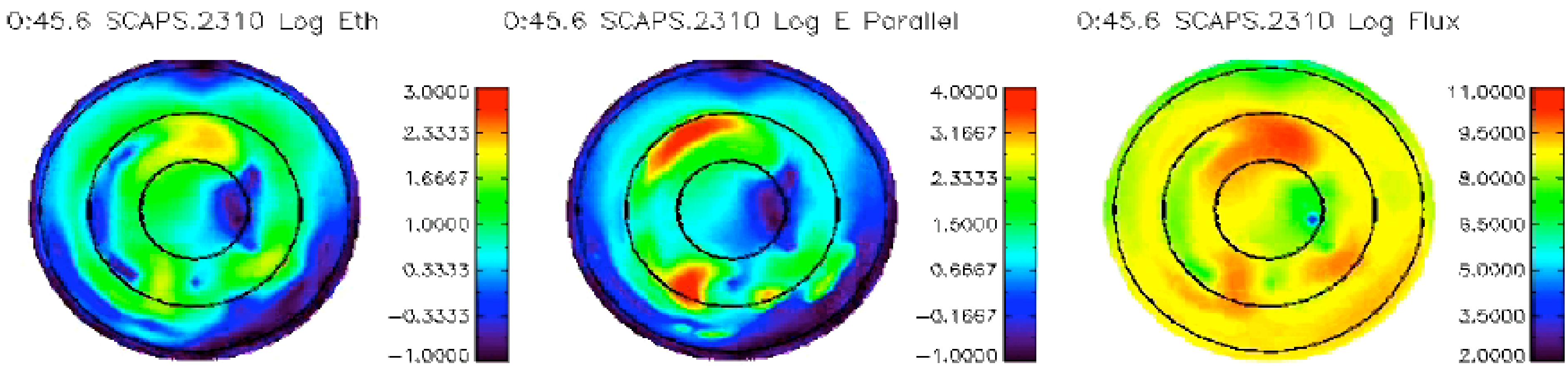


Dynamic Particle Boundary Conditions: Pd increase



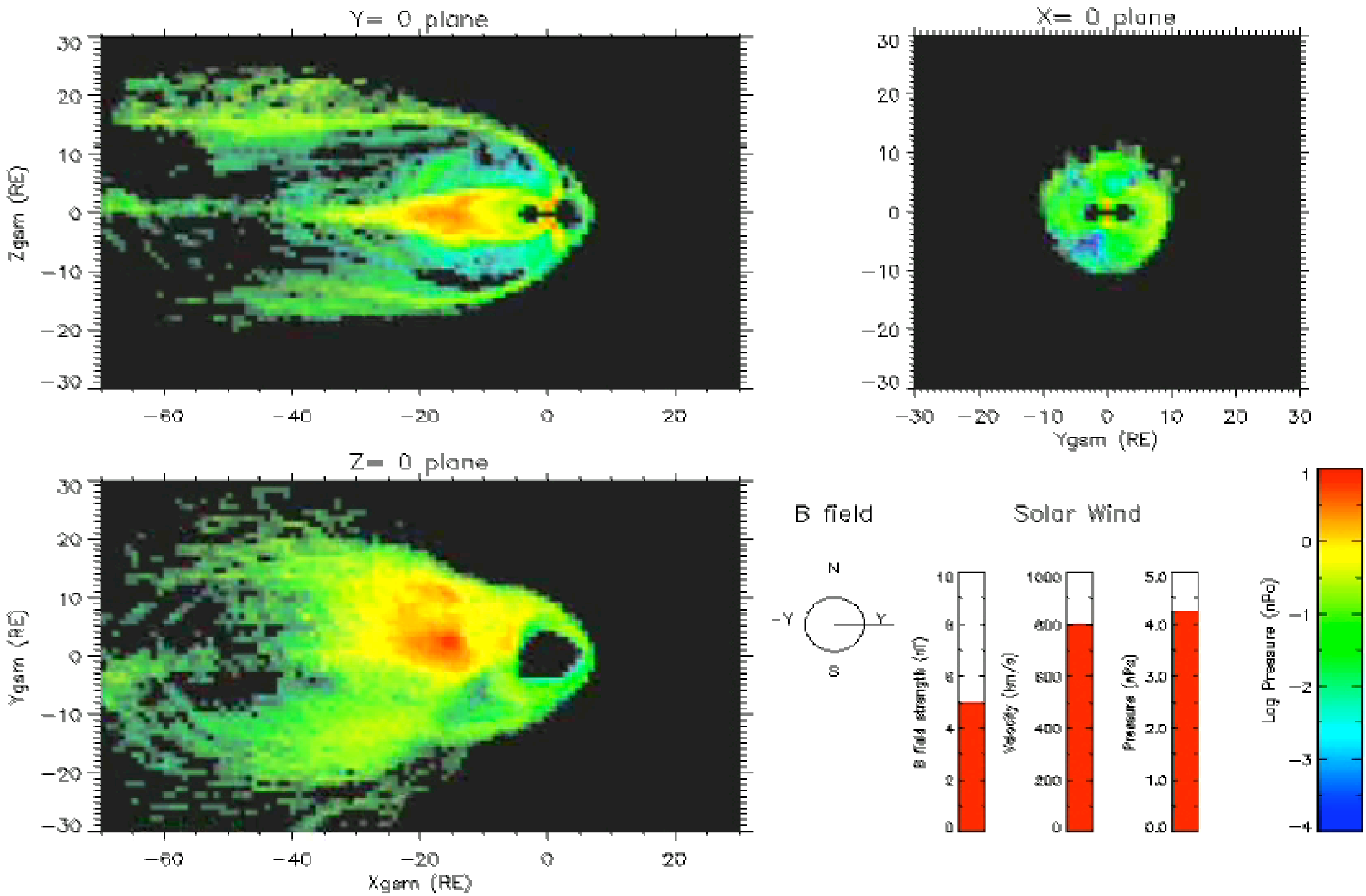
North

Eperp (Poynting Flux) Eparl (J// and Knight) Escape Flux (Ne + **S**)

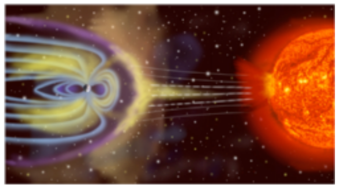


South

Dynamic Auroral Wind: Pd Increase



CONCLUSIONS



- Global auroral wind circulation linked to localized, dynamic boundary condsitions from MHD per Strangeway et al. [2005], Zheng et al. [2005]
- Pre-existing auroral wind O^+ outflows are highly compressed by solar wind pressure increase
- O^+ outflow increases with pressure increase, but arrival delayed
- Auroral wind O^+ inflates plasma sheet and inner magnetosphere
- Largest geospace storms supported by atmospheric ablation

Future Work

- Move to global simulations with ionospheric plasmas as dynamical elements, e.g. Winglee code